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OCULAR PROBLEMS OF THE AGING MILITARY AVIATOR

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INTRODUCTION:

Approximately 20% of all the USAF aviators are now over the age of 40. Over 60% of the U.S. civilian airline pilots are over the age of 40. Because of the age 60 rule, these pilots must retire when they reach 60 years of age.

We decided to look at what are the ocular/visual problems that brought our senior USAF aviators to the Consultation Service at the USAF School of Aerospace Medicine at Brooks AFB, Texas. The Consultation Service evaluates all USAF aviators who have a medical problem that threatens their flight status. Following a thorough medical workup, our staff makes a recommendation to the USAF Surgeon General's Office. This might be grounding, further treatment, a waiver to return to flight status or change in flight status. (1)

METHODS:

The medical records of all USAF aircrew over age 45 were examined. They were seen in the Consultation Service from 1 Jan 86 through 19 Dec 95, a 10-year study. These individuals were sent to us to be evaluated for their fitness to return to the cockpit. The frequency with which these ocular conditions were seen was noted, as were the causes for grounding of these individuals. One could ask an important question here: Have advancements in medicine and science since 1959, when The Age 60 (2) rule came into being, had any effect on these ocular conditions seen in the older aviator and on his flight status?

FINDINGS:

The total number of new cases over age 45 seen during this 10-year period was 149 aircrew. Their ages ranged from 46 to 71 years, with the average age being 50.1 years. A few of the older subjects were retired military aviators now working as civilian flying instructors for the U.S. Army. Table 1 shows the breakout of the aircrew positions.

TABLE 1. BREAKOUT OF AIRCREW POSITIONS

Pilots	100
Navigators	33
Flight Surgeons	12
Loadmasters	2
Gunner	1
Flight Engineer	<u>1</u>
TOTAL	149

In table 2 we see the variety of ocular conditions that were potentially grounding and therefore these cases were sent to the Consultation Service for disposition.

TABLE 2. DIAGNOSES AND FREQUENCY

Presbyopia	149*
Glaucoma/Intraocular hypertension	41
Aphakia w/intraocular lens or contact lens	35
Stereo/motility problems	19
Keratoconus or excessive refractive error	7
Retinal detachment/surgery	9
Central serous retinopathy/surgery	9
Retinal/lattice degeneration	5
Cataracts	4
Color vision defects	3
Uveitis iritis	3
Optic neuritis/ischemic neuropathy	3
Ocular trauma/angle recession	3
Branch retinal vein occlusion	2
Miscellaneous diagnoses on Table 3	<u>11</u>
Total diagnoses exclusive of presbyopia	154

*All had presbyopia

The Miscellaneous diagnoses are shown in Table 3.

TABLE 3. MISCELLANEOUS DIAGNOSES

Acephalgic migraine	1
Corneal dystrophy (map dot)	1
Adult-onset Best disease	1
Nutritional amblyopia (RPW)	1
Fuch's heterochromic iridocyclitis	1
Central areolar choroidal dystrophy	1
Ocular floaters	1
Ocular histoplasmosis	1
Trabeculectomy w/mitomycin C	1
Herpes simplex with corneal erosions	1
Superior oblique myokymia w/oscillopsia	1
TOTAL	11

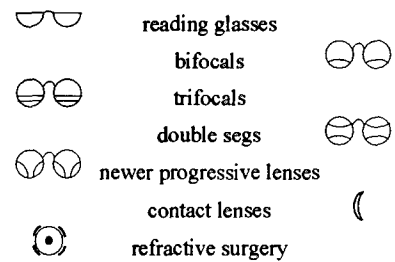
Of the 149 subjects seen, 30 were disqualified for flying duties. This is 20% of the total. However, only 12 (8%) were disqualified for ophthalmic diagnoses, whereas 18 (12%) were disqualified for other medical conditions, predominantly cardiovascular. Therefore, these disqualifications were 40% for ocular reasons and 60% for other medical conditions. Overall, 80% of these over-age-45 aircrew were retained on flight status and only 20% were disqualified. The 12 (8%) disqualifying ophthalmic diagnoses are shown in Table 4.

TABLE 4. DISQUALIFYING DIAGNOSES

Cataract	1
Traumatic cataract	1
Glaucoma/miotic use	1
Glaucoma with visual field defects	1
Pigmentary glaucoma with visual field defects	1
Trauma with VI nerve paresis	1
Superior oblique myokymia	1
Choroidal dystrophy	1
Central serous retinopathy	1
Retinal detachment with decreased visual acuity	1
Anterior ischemic neuropathy	1
Herpetic keratitis with corneal erosions	1
TOTAL	12

DISCUSSION: Under present FAA regulations, the longest flying career one can expect is approximately 35 years. The last 15 years (from age 45 to age 60) should be the most productive for an aviator. New aircraft and high-tech cockpits have not decreased the importance of the visual sense in flying. In fact, vision now is even more important, since there has been an increased load on near vision (cockpit vision) just at the age when that function begins to gradually decrease in its capabilities. Our survey showed that none of the subjects could escape presbyopia. All 149 subjects needed a spectacle

correction to pass the near vision test at 14 inches; however, we are aware that a substantial number of these individuals can get by in the cockpit without spectacle help, at least for a few years. But by age 50, no one can do the job in the cockpit without a visual aid. Even though this is a universal problem, fortunately one can correct it 100% of the time. Old and new optical technology has given us reading glasses, bifocals, trifocals, double segs, newer progressive lenses, contact lenses, and now every refractive surgery. (Fig 1)



Excluding presbyopia, in descending order of occurrence, (See Table 2) the next six diagnoses represented 78% of the conditions potentially grounding these aviators who were seen in our branch. The conditions were glaucoma and intraocular hypertension (27%); aphakia with intraocular lens or contact lens correction (22%); stereopsis and motility problems (12%); keratoconus and excessive refractive errors (6%); retinal detachment with and without surgery (6%); and central serous retinopathy with and without surgery (5%).

When The Age 60 rule came into being and one of us (TJT) began his career caring for AF aviators, back then a diagnosis of glaucoma was a reason for commencing drug treatment of the disease. This was usually with miotic drugs and this meant that one could be assured of being grounded for this condition. However, work done since then in the Ophthalmology Branch at USAFSAM allowed other drugs to be used in USAF aviators and, a Glaucoma/Intraocular Hypertension Surveillance Only Program was initiated. The sum total of all this was that what was almost a sure grounding in 1959 is now grounding in less than 10%; over 90% of our glaucoma/ocular hypertensive cases are kept on full flight status throughout their flying careers. In the Surveillance Only part of the program no drug therapy is used but the flight surgeon must monitor the intraocular pressure at three months intervals. At six months a visual field is done along with an evaluation of the optic nerve. If the aviator has a diagnosis of glaucoma he/she is placed on drug therapy at once. Presently the USAF protocol allows epinephrine derivatives, and beta blockers as the only drugs used to treat glaucoma in the aviator. This is so because these two drug groups do not alter the aviator's visual capabilities. (3) Ninety-two percent of these senior aviators with glaucoma/

intraocular hypertension were returned to full flight status.

The next most frequently seen affliction in senior aviators was cataracts (22%). Once again, in 1959 a diagnosis of cataract was the death-knell of an aviation career. First, by the use of contact lenses (first hard lenses and then soft) and now, with the advent of intraocular lens replacement for the natural lens, almost every aviator with cataracts can have surgery and be returned to full flight status. (4) In 1974, we returned the first aphakic aviator to flying using a contact lens to correct the aphakia, and in 1979, the first USAF aviator with an intraocular lens was returned to flying. Prior to this (in 1978) we had placed intraocular lenses in a dozen primates. After a period of healing they were subjected to up to +12 Gz. None of these lenses dislocated. We have found this to be true in following our aviators, in 20 years, only one subject dislocated his lens but this was in a secondary implantation and accidental, not during the performance of his flying duties. We presently have 65 USAF aviators (80 eyes) with intraocular lenses, 15 of them have binocular IOLs. Almost all of them (97%) have attained 20/20 vision. They fly all types of USAF aircraft from F-15 and F-16 to C-130s. Even one astronaut has flown in space with bilateral intraocular lenses in place. Only 2 of 35 of the senior aviators in this study were grounded. Ninety-four percent being returned to full flight status.

Twelve percent of our subjects had ocular motility/stereopsis problems. We discovered, that in the early 1970s, that many of the individuals who had failed stereopsis, but had "straight"-appearing eyes, had a newly discovered condition called microtropia. (5) Most of these microtropes were found to have excellent flying records and were retained on full flight status. Over 220 such individuals now have been seen in the Consultation Service since we discovered this condition in aviators. Two of the 19 motility cases in this study were grounded; thus 90% were retained on flight status.

Five percent of the cases seen had keratoconus or excessive refractive errors. One hundred percent of these were correctable by advances in optical and contact lens science and technology and returned to full flight status. This was not always so. Back in 1959, if a keratoconus case could not be corrected by spectacle lenses, and it usually could not, a military aviator's career was ended unless had a successful corneal transplant. With the advent of hard contact lenses, nearly all of our keratoconus cases could be returned to flying. (6) We now have over 60 keratoconus cases that are being followed at our institution, most wearing hard contact lenses to correct their corneal condition. In the history of our branch only one keratoconus case had corneal transplant surgery and unfortunately the surgery proved not to be successful.

Six percent of the cases reviewed were retinal detachments. Most had some form of surgery, from laser retinopexy to detachment surgery with full encircling bands. In 1959, probably none of these cases could have been rehabilitated completely. Only one of our nine cases failed to return to flight status, the other eight had successful retinal reattachments and, with optical correction (89%), were able to be returned to full flight status.

The 11% disqualification rate for retinal detachments in senior USAF aviators is the same rate we found in a previous study done in our branch looking at all the aviators evaluated for retinal detachments. (7) The effects of aviation duties especially G-forces always needs to be considered in these detachment cases. To date none of the cases in this study have re-detached. In the previous study encompassing 1967 through 1986 one case re-detached. From our experience one can say that a successfully surgically attached retina most likely will not re-detach and it is safe to return such individuals to full flight duties. (8) Obviously, after having undergone a complete and thorough ophthalmologic evaluation such as used in our branch, along with periodic follow-up with dilated ophthalmologic examinations.

The final one of these six diagnostic conditions was central serous retinopathy (6%). This is the only group whose prognosis was probably the same in 1959 as today. (9) True, there are better diagnostic procedures available and laser treatment of the retinal leak is presently used, but, then as now, most of the cases healed without any treatment at all. The one central serous retinopathy case grounded in this study was severe enough to require laser treatment, which did not succeed, however, 89% of the subjects, seen were eventually returned to flying.

The remaining 22% of the cases consisted of miscellaneous diagnoses as shown in Tables 2 and 3, consisting of 18 different diagnostic entities. The ophthalmic diagnoses of the disqualified cases are shown in Table 4. Three of the 12 were disqualified for glaucoma, two had cataract complications, two had motility disorders, three had choroidal/retinal conditions, one had an optic nerve neuropathy and one had a corneal disorder due to herpes simplex.

CONCLUSIONS:

We see that only these 12 (8%) were disqualified for flying because of an ocular condition. 92% of these senior USAF aviators were eligible to be returned to full flight status from the ophthalmologic standpoint, even though they had been diagnosed with significant ocular diseases. As we asked at the onset what would have happened to their flying career in 1959 as compared to today. All 149 subjects had successful correction of their presbyopia. This could also have been done 40 years ago

but the lenses and frames today are lighter and more compatible with the other equipment worn.

Forty years ago most of the glaucoma cases (Intraocular/hypertension had not as yet been diagnosed) would have been grounded. Over 90% of these now continue on to a full flying careers. In 1959 all aviators with cataracts would have been grounded-career ended. Today 94% of those seen in this study with an intraocular lens implant were returned to flying. 90% of the ocular motility/stereopsis cases were able to stay on flight status. Most of the cases in this study had mild to moderate keratoconus but with skillful use of optical and contact lens technology 100% were returned to full flight duties. Only one of the nine retinal detachment cases was unsuccessful so even with this serious ocular condition 89% of these senior USAF aviators returned to flying.

Senior military aviators can be afflicted with ocular conditions not much different from the younger aviator, except for the conditions of presbyopia, glaucoma/intraocular hypertension and cataracts. Fortunately for the present day senior aviator medical science and optical and ophthalmic technology advancements have made these conditions amenable to successful treatment or correction so that they no longer should be a cause of a shortened flying career, as they once were.

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